iGEM 2015 Interlab Study

Organized by Jacob Beal, Traci Haddock, Markus Gershater, et al.

Why do an interlaboratory study?

Measurement in Synthetic Biology:

- How precisely can the behavior of a part be characterized?
- How much do *de facto* protocols for measurement vary?
- What are the dominant causes of variation in measurement?

Measurement is fundamental to everything we do.

What we asked teams to do

- Build three constitutive GFP constructs

  Or arrange alternatives, if these weren't possible
- Culture & measure fluorescence
- 3 biological replicates (Extra: x 3 technical rep.)

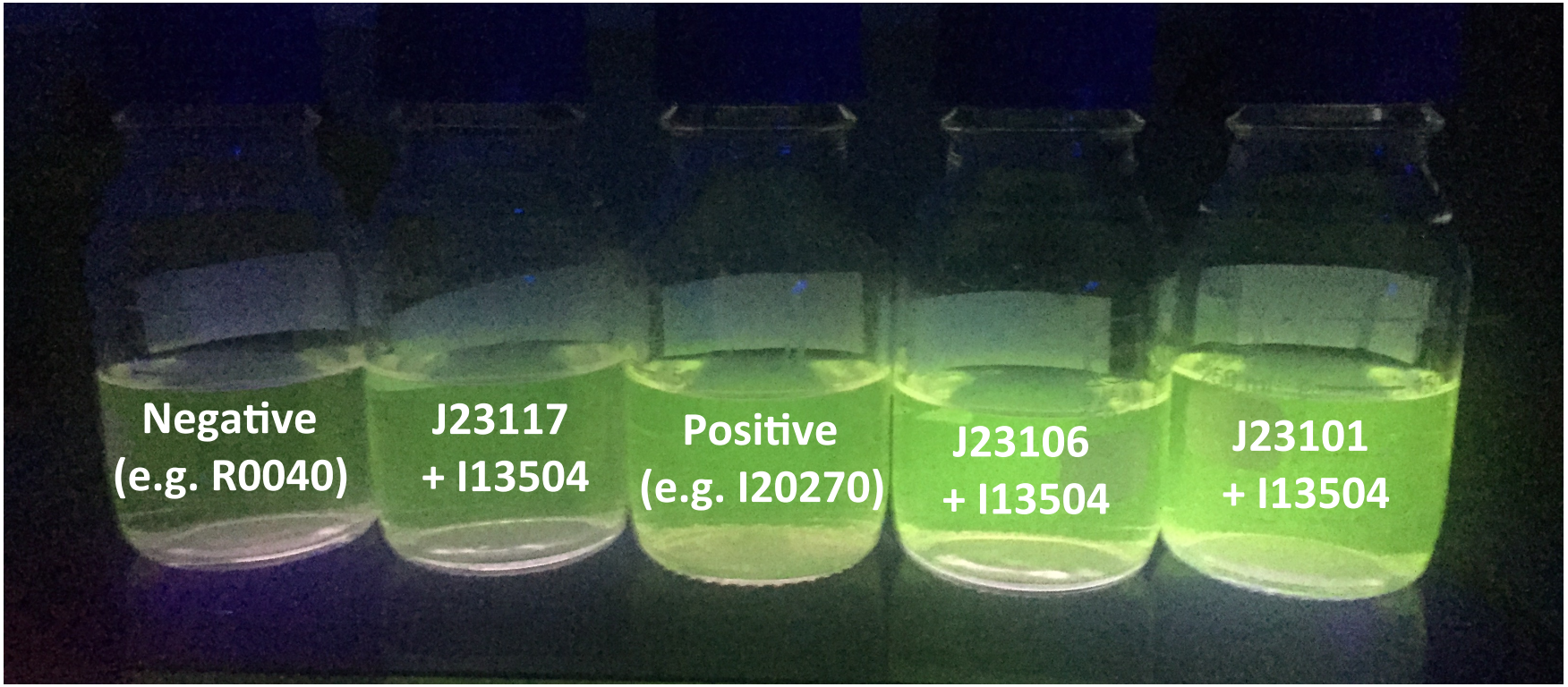
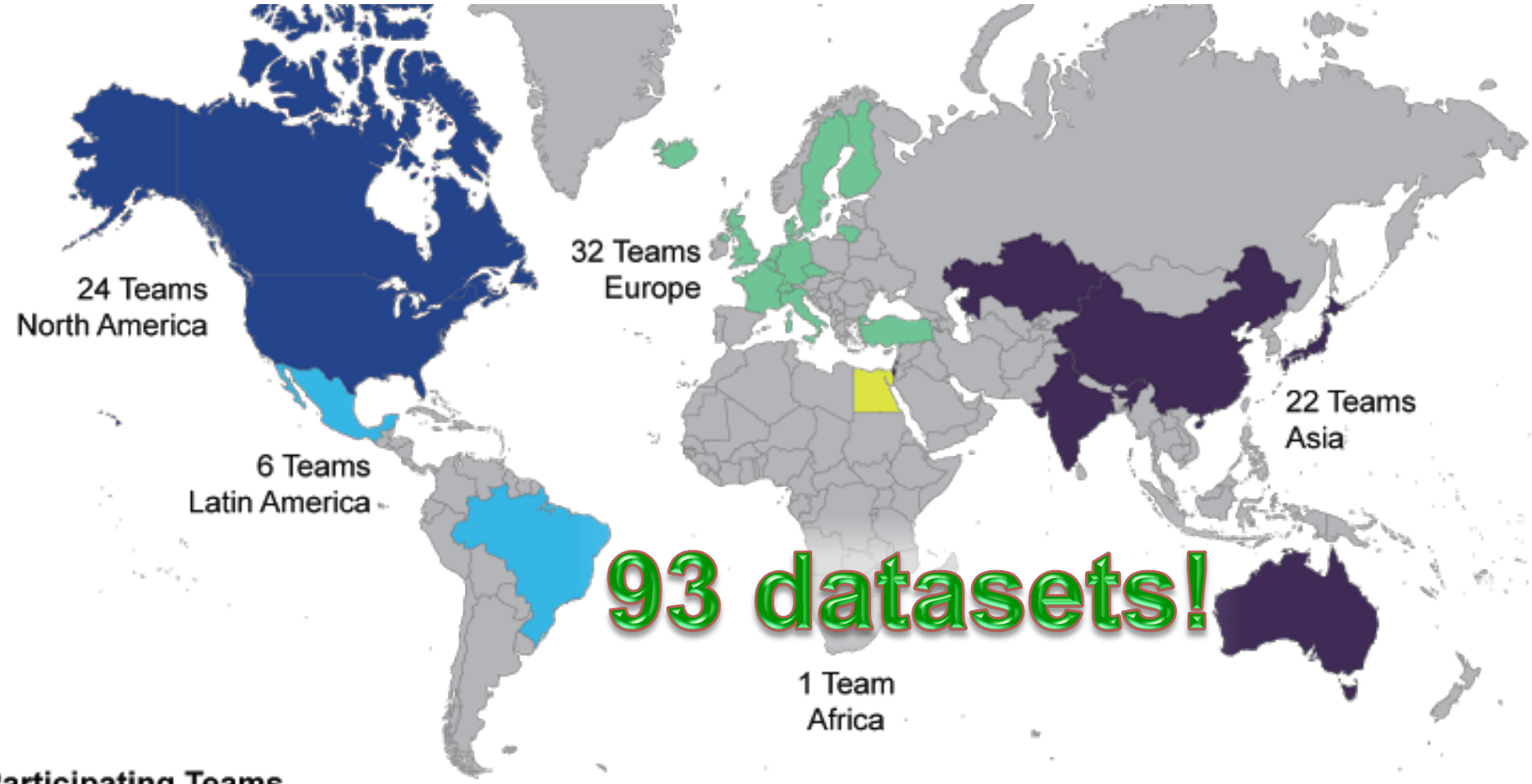


Image from iGEM Oxford

Worldwide Participation!



Participating Teams

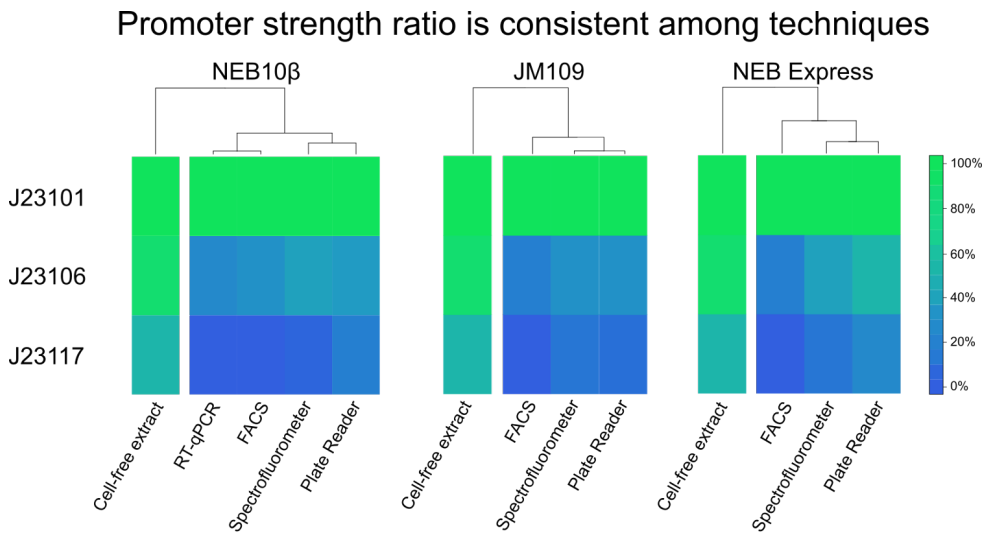
Aalto-Helsinki	Birkbeck	CU Boulder	Glasgow	London Biohackspace	NJAU_China	Rock Ridge Virginia	TecCEM HS	Tufts	Waterloo
Aix-Marseille	BIT	Czech_Republic	Harvard_BioDesign	LZU	Northeastern	SCUT	Tec_Monterrey	UCL	William and Mary
Amoy	Boston University	Duke	Hong_Kong-CUHK	Marburg	NRP-UEA	SDU-Denmark	Tokyo Tech	UCLA	WLC-Milwaukee
ANU-Canberra	Brasil-USP	Edinburgh	HUST-China	METU_Turkey	NTNU-Trondheim	SPSingapore	Toronto	UC San Diego	WPI-Worcester
ATOMS-Turkiye	Cairo_Egypt	EPF_Lausanne	HZAU-China	Minnesota	NU_Kazakhstan	Stanford-Brown	Trento	UFMG_Brazil	
Austin_UTexas	Carnegie Mellon	ETH Zurich	IISER_Pune	MIT	OUC-China	Stockholm	TrinityCollegeDublin	UMaryland	
BHSF_Beijing	CityU_HK	Exeter University	KU Leuven	Nanjing_NFLS	Oxford	SYSU-Software	TU Delft	Utah_State	
Bielefeld	Cork	Freiburg	Leicester	Nankai	Paris-Saclay	SZMS_15_Shenzhen	TU_Eindhoven	Vanderbilt	
BIOSINT Mexico	CSU_Fort_Collins	Gifu	Lethbridge	NEAU-China	Pasteur	TecCEM	Tuebingen	Vilnius-Lithuania	

What did people use?

- Instruments:
  - Plate Reader: 56
  - Flow Cytometer: 23
  - Microscope: 7
  - Spectrofluorimeter: 5
  - Other: 2
- Strains:
  - DH5-alpha: 50
  - TOP10: 14
  - BL21: 9
  - Other: 20
    - XL1-Blue, JM109, 10G, RP437, MG1655, DH10-Beta, KRX

Above and Beyond!

Multiple strains and instruments!



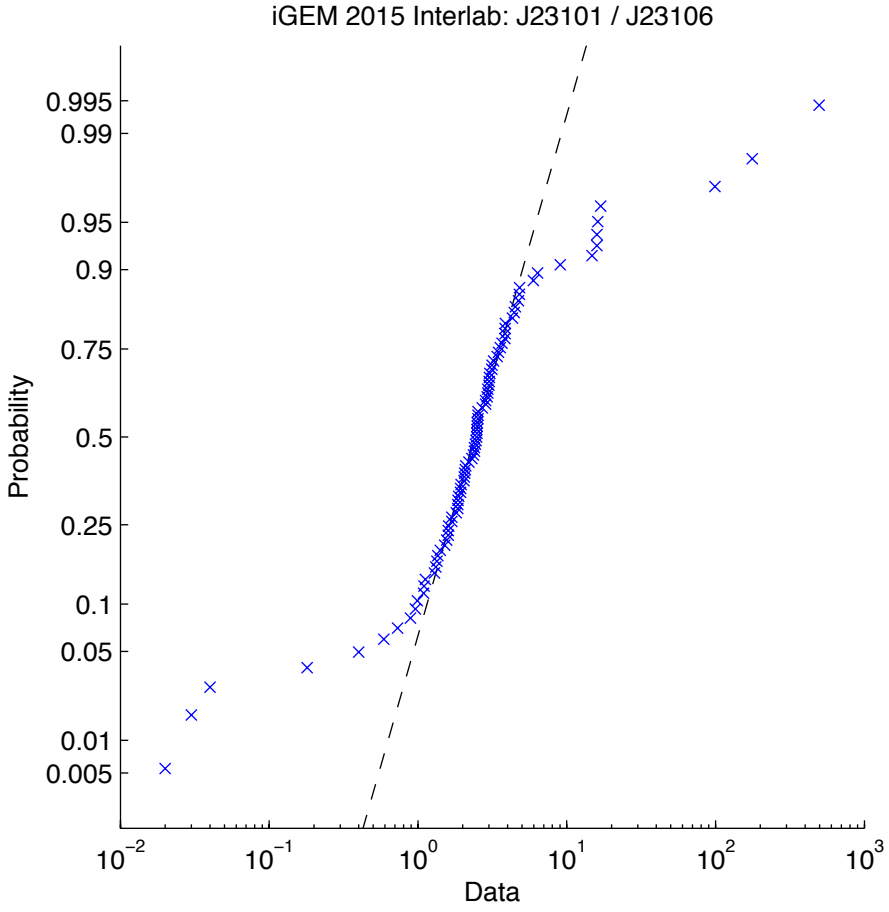
New Custom Equipment!

We love how iGEMers surprise us!

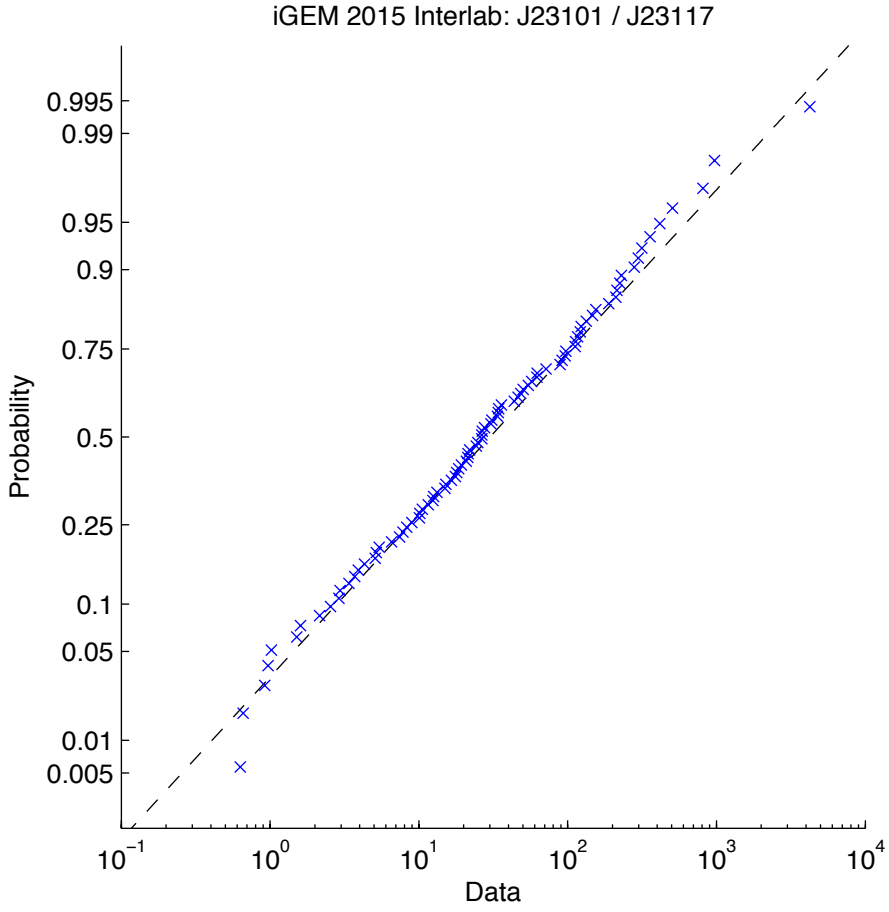
Image from iGEM UNITN-Trento, Aix-Marseille

Results: Measurement Precision

J23101 (High) vs. J23106 (Med.)



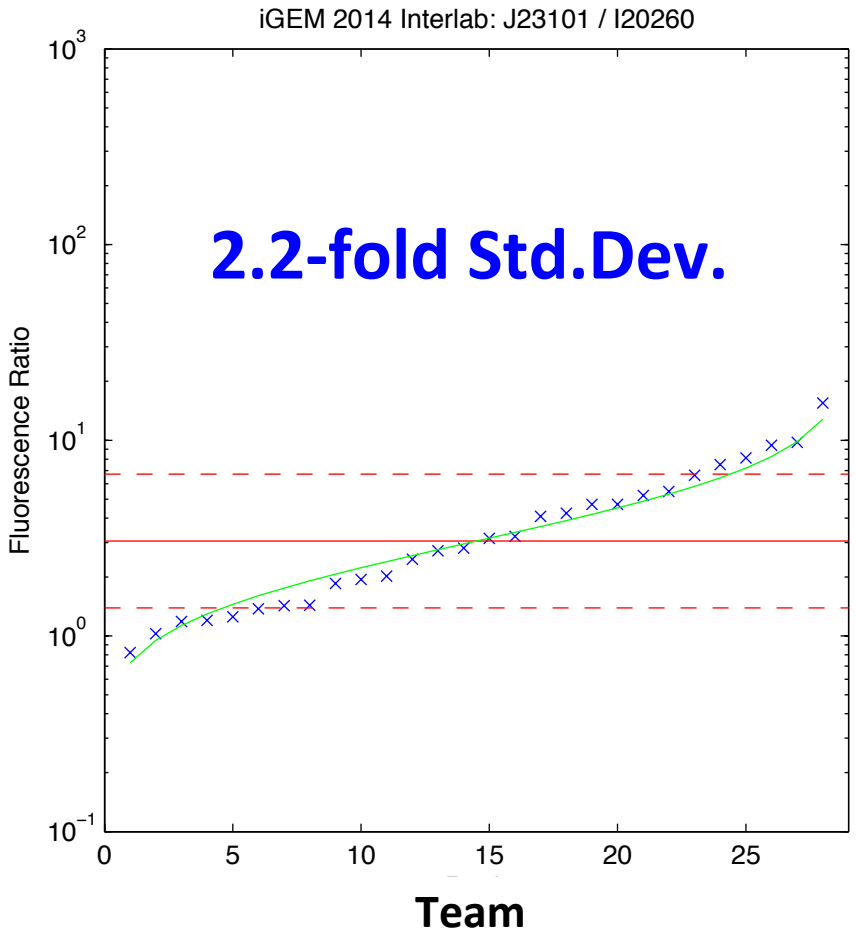
J23101 (High) vs. J23117 (Low)



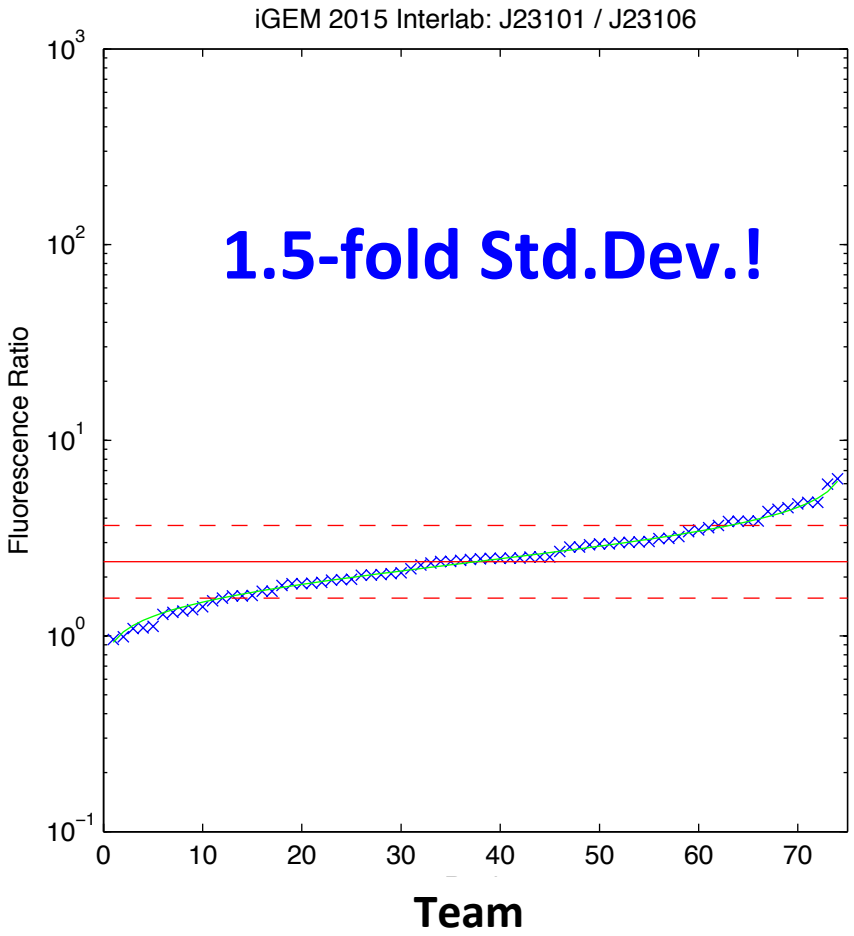
High measurements more precise than low

Results: 2015 vs. 2014

2014: J23101 (High) vs. I20260 (Med)



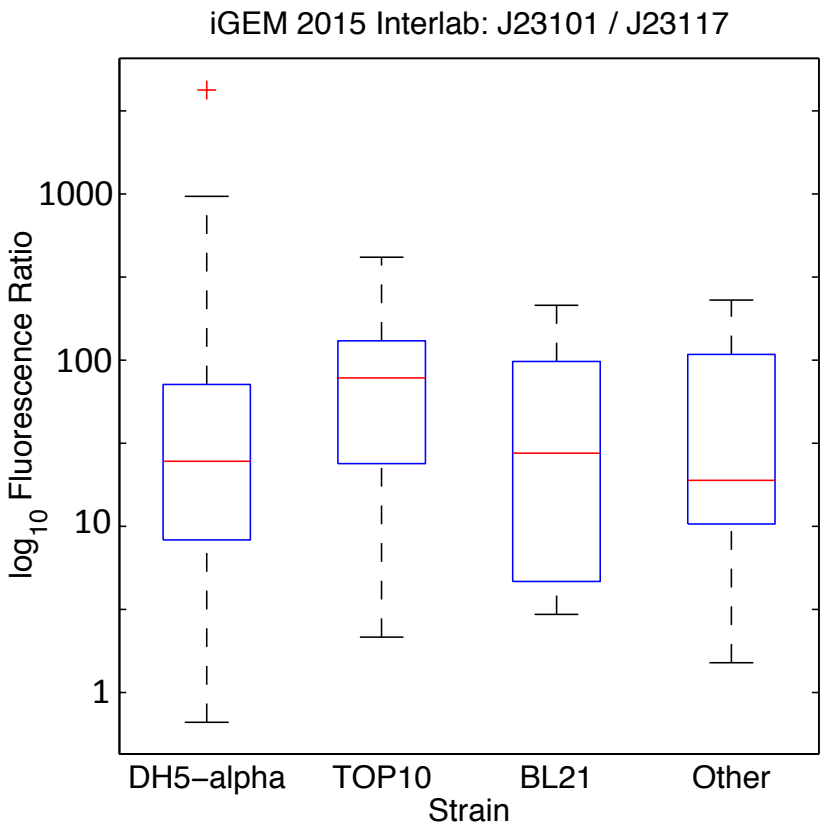
2015: J23101 (High) vs. J23106 (Med)



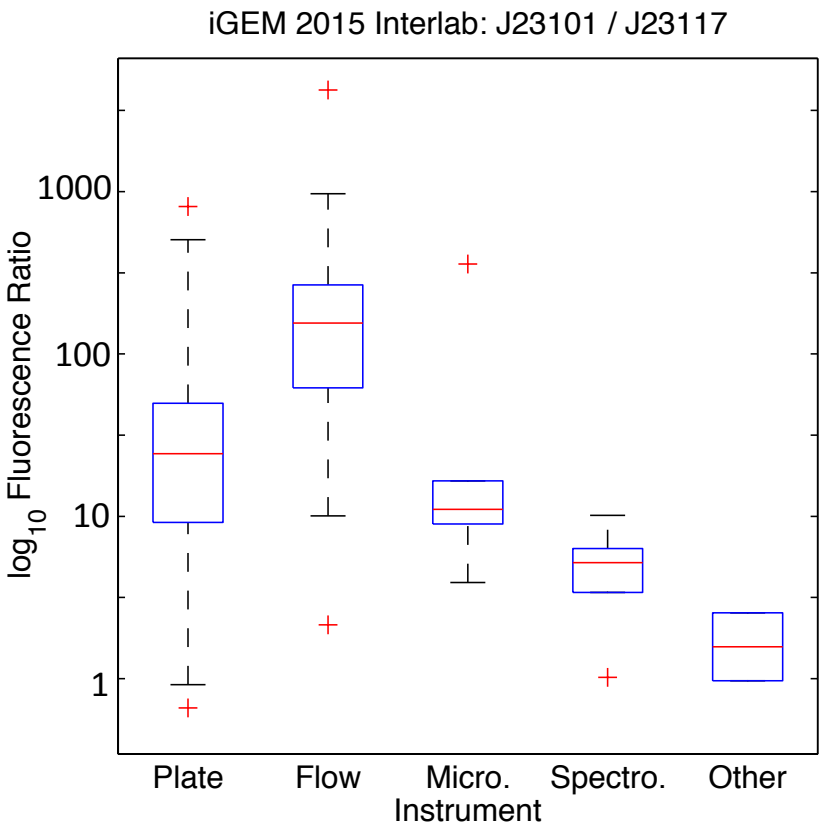
More specific protocol → tighter distributions

Results: Cause of Variation?

Strain

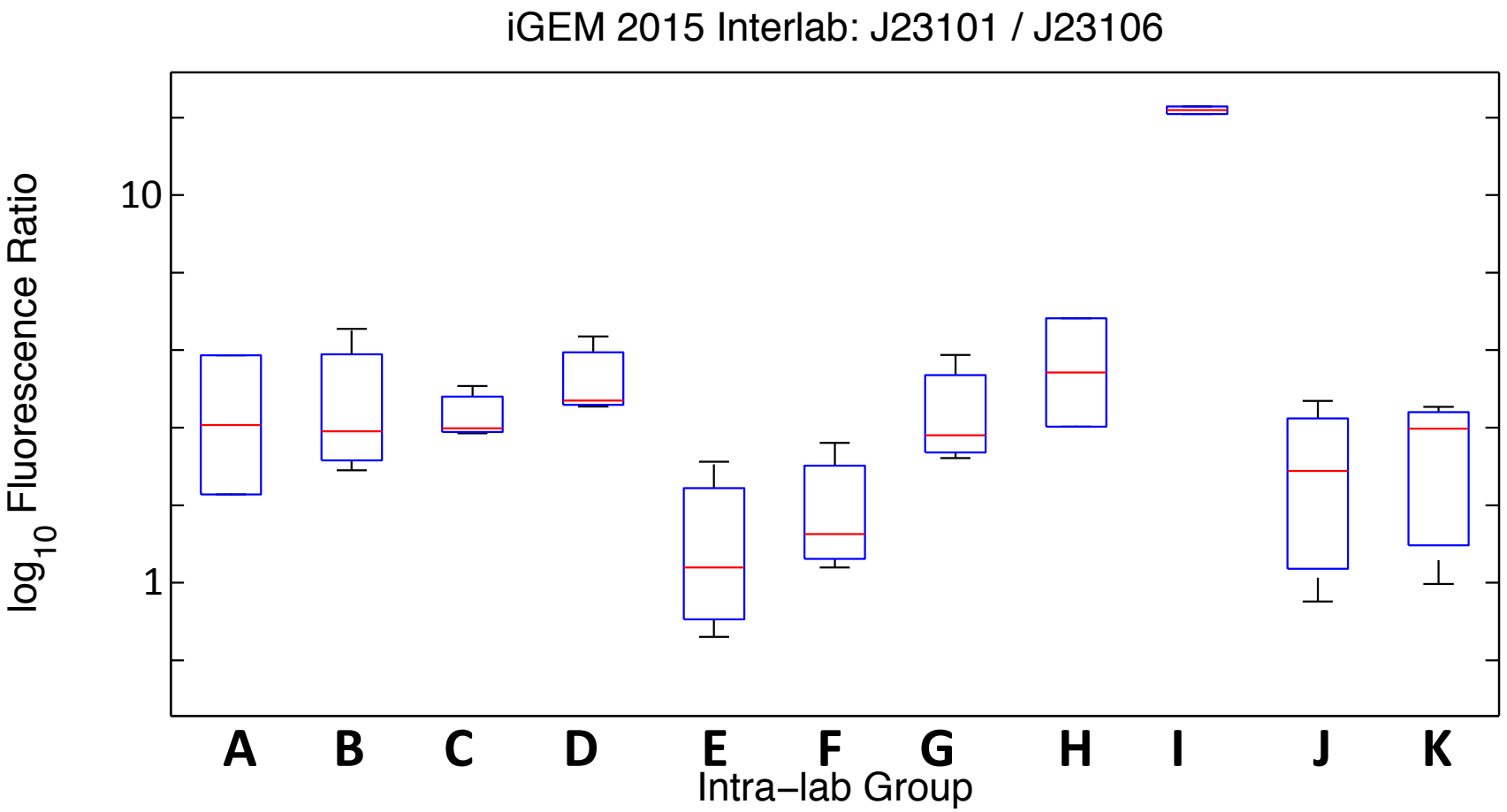


Instrument



Instrument matters, especially for low values.
Strain, not so much.

Results: Intrateam Variation



High instrument variation on single samples!

Time for Feedback!

What worked? What didn't work?

How can it be bigger and better next year?